SLOW-MOVING DISINTEGRATING ROCKSLIDES ON MOUNTAIN SLOPES

R. COUTURE and S.G. EVANS

Abstract

Mountain slope movements have been recognized at numerous sites in Glacier National Park (GNP), British Columbia, especially along the transportation corridor through the Columbia Mountains, one of the most important in western Canada. The corridor links Golden and Revelstoke via Rogers Pass, and is utilized by the Canadian Pacific railways and the Trans-Canada Highway (Figure 1). Characterized by glacially overdeepened valleys and steep mountain slopes underlain by complex metamorphic rocks, the GPN landscape is especially prone to major slope movements. These slope movements are characterized by massive bedrock landslides and sagging slopes in which movement may result from sliding, toppling and flow, either singly or in combination. The influence of geology, rock mass fabric, and slope morphology on the mode of failure of slopes in GNP is illustrated by an ongoing multiple-mode slope movement in the Beaver River Valley, the East Gate landslide. The hazard assessment framework, as well as the influence of climate in triggering the failure, is discussed. Comparison with other similar examples of complex landslides in the French Alps is briefly outlined.

1. Introduction

Mountain slope movements have been recognized at numerous sites in Glacier National Park (GNP), British Columbia, especially along the transportation corridor through the Columbia Mountains. This corridor, one of the most important in western Canada, links Golden and Revelstoke via Rogers Pass, and is utilized by the Canadian Pacific railway and the Trans-Canada Highway (Figure 1). Characterized by glacially overdeepened valleys and steep mountain slopes underlain by complex metamorphic rocks, the GNP landscape is especially prone to major slope movements. The Beaver River Valley forms the eastern approach to Rogers Pass and is particularly affected by deep-seated slope movements. Several slope movements have been investigated [29, 28, 9]. Large deep-seated landslides on the Beaver River Valley slopes cause maintenance problems on both the CPR grade and the Trans-Canada Highway [28]. Pritchard & Savigny [27] showed the distribution of landslides and evidence of a toppling process.
In this paper, we present a brief overview of the regional and structural geology as it relates to geotechnical rock mass fabric and outline the characteristics of major slope movements in the vicinity of the Glacier National Park. These slope movements are characterized by massive bedrock landslides and sagging slopes in which movement may result from sliding, toppling and flow, either singly or in combination. The influence of geology, rock mass fabric, and slope morphology on the mode of failure of slopes in Glacier National Park is illustrated by the East Gate landslide (EGL), an ongoing multiple-mode slope movement in the Beaver River Valley. This landslide resulted in a debris flow that first blocked the Trans-Canada Highway in early May 1999. Observations from 1999, 2000 and 2001 field reconnaissance surveys are summarized in the following paragraphs.

![Figure 1](image1.jpg)

**Figure 1.** Location of East Gate Landslide in Beaver River valley, Glacier National Park, British Columbia. TCH : Trans-Canada Highway.

### 2. Morphological and Geological Setting

The Beaver River Valley is located in the Omenica Tectonic Belt in British Columbia [35, 15, 14]. The Beaver Valley is situated between the Prairie Hills of the Purcell Mountains on the east and the Hermit and Sir Donald Ranges of the Selkirk Mountains. The highest summit in the Prairie Hills is at about 2480 m elevation and located just above the East Gate landslide. The valley floor is at elevation 820 m. The natural slope angles in the valley vary from 23° to 40°.

The east side of the Beaver Valley is formed in rocks of Hadrynian (Late Precambrian) Horsethief Creek Group. Poulton and Simony [26] divided the Horsethief